

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)	
)	
Inquiry Concerning the Deployment of)	GN Docket No. 09-137
Advanced Telecommunications Capability)	
to All Americans in a Reasonable and)	
Timely Fashion, and Possible Steps to)	
Accelerate Such Deployment Pursuant to)	
Section 706 of the Telecommunications Act)	
of 1996, as Amended by the Broadband)	
Data Improvement Act)	
)	
)	
A National Broadband Plan for Our Future)	GN Docket No. 09-51

COMMENTS OF ADTRAN, INC.

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Summary

ADTRAN addresses in these comments certain of the issues raised in this Commission proceeding to develop a report to Congress under Section 706. Because this proceeding is taking place concurrently with the Commission's development of the National Broadband Plan, ADTRAN urges the Commission to define "broadband" and "advanced telecommunications capability" the same in both proceedings. On the other hand, ADTRAN believes the Commission should not use the definition developed by NTIA and RUS for their grant/loan programs, because that definition is static and dependent on the amorphous concept of "advertised speed," which is subject to confusion and/or manipulation.

ADTRAN instead urges the Commission to define "broadband" from the perspective of the subscribers' experience. ADTRAN also believes that the definition should be multidimensional and evolutionary (rather than static). As such, ADTRAN believes that "broadband" should incorporate speed (or throughput) as reflected in the rate that subscribers actually experience or are likely to experience with high probability ("sustainable" speed), as opposed to some theoretical maximum or peak rate. In addition, the definition should account for latency, and should be revisited periodically to reflect changes in the common classes of applications used by subscribers.

Finally, ADTRAN urges the Commission to take notice of the continuing advances in DSL technologies. New techniques such as vectoring and pair bonding have greatly increased the throughput capabilities of DSL, thus allowing service providers to make effective and efficient use of the embedded copper loops.

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ADTRAN, Inc. ("ADTRAN") takes this opportunity to address certain issues raised in this Notice of Inquiry to support the Commission's Section 706 Sixth Report concerning whether broadband is being deployed to all Americans in a reasonable and timely manner.¹ The Commission is undertaking this inquiry pursuant to Congress' directive in Section 706 and in parallel with its proceeding to develop a National Broadband Plan.² ADTRAN filed several submissions in the *National Broadband Plan*

¹ *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act; A National Broadband Plan for Our Future*, GN Docket Nos. 09-137 and 09-51, FCC 09-65, released August 7, 2009 (hereafter cited as "*Section 706 NOP*").

² *A National Broadband Plan for Our Future* (Notice of Inquiry), 24 FCC Red 4342 (2009) (hereafter cited as "*National Broadband Plan NOP*").

NOI and related proceedings, which are incorporated into this proceeding.³ ADTRAN seeks in these comments to reiterate, expand upon and amplify those earlier submissions.

ADTRAN, headquartered in Huntsville, Alabama, is a leading global manufacturer of networking and communications equipment, with an innovative portfolio of more than 1,700 solutions for use in the last mile of today's telecommunications networks. ADTRAN's equipment is deployed by some of the world's largest service providers, as well as distributed enterprises and small and medium businesses. Importantly for purposes of this proceeding, ADTRAN solutions enable voice, data, video and Internet communications across copper, fiber and wireless network infrastructures. Because of the breadth of its product lines, ADTRAN is not wedded to any one last-mile technology. Rather, ADTRAN believes that copper, fiber and wireless will all be necessary for the deployment of robust, ubiquitous and affordable broadband. ADTRAN thus brings an expansive perspective to this proceeding.

I. Defining Broadband

In this *Section 706 NOI*, the Commission asks once again how it should define "advanced telecommunications capability" and "broadband" for purposes of the sixth report, and whether these definitions should be consistent with those adopted in earlier reports, other Commission proceedings, or other agencies' proceedings.⁴ ADTRAN

³ *Section 706 NOI* at ¶ 14. See, ADTRAN Comments in Docket 09-51, filed August 31, 2009; Reply Comments of ADTRAN in Docket 09-51, filed July 21, 2009; Ex Parte Notice of ADTRAN in Docket 09-51, filed June 23, 2009; Ex Parte Notice of ADTRAN in Docket 09-51, filed May 22, 2009; Ex Parte Notice of ADTRAN in Docket 09-40, filed April 13, 2009; Ex Parte Notice of ADTRAN in Docket 09-40, filed April 6, 2009; Ex Parte Notice of ADTRAN in Docket 09-29, filed March 13, 2009.

⁴ *Section 706 NOI* at ¶¶ 34-36.

believes the Commission should define these terms in a manner consistent with the terms' use in the National Broadband Plan, but should decline to use the definitions adopted by the National Telecommunications and Information Administration ("NTIA") and Rural Utilities Service ("RUS") in their recent Notice of Funds Availability (NOFA).

A. *Consistency in Definitions*

Section 706 uses the phrase "advanced telecommunications capability," while the American Recovery and Reinvestment Act of 2009 ("ARRA") directs the Commission to develop a national "broadband" plan. ADTRAN believes that Congress' use of slightly different terminology was not intended to have the Commission study different services or technologies, and thus concurs with the Commission's decision to use these terms interchangeably.⁵ The Commission is concurrently conducting proceedings under each of these statutes. ADTRAN believes that the Commission should define broadband/advanced telecommunications capability identically in the parallel proceedings. While the development of a National Broadband Plan is a "forward looking" exercise and the Section 706 Report will be an assessment of current conditions, the services being focused on in both proceedings should be the same. As discussed below, ADTRAN offers some suggestions on the definition of broadband/advanced telecommunications capability that would apply to both the *Section 706 NOI* and the development of the National Broadband Plan, including the notion that the definition be "evolutionary" and thus consistent with the forward-looking nature of the National Broadband Plan proceeding.

On the other hand, ADTRAN urges the Commission not to adopt the definition of

⁵ *Section 706 NOI* at ¶ 4.

“broadband” developed by NTIA and RUS for purposes of awarding grants and loans under the ARRA. The NOFA defines “broadband” as:

Broadband means providing two-way data transmission with advertised speeds of at least 768 kilobits per second (kbps) downstream and at least 200 kbps upstream to end users, or providing sufficient capacity in a middle mile project to support the provision of broadband service to end users.

ADTRAN has several concerns with this definition. First, given its limited purpose – determining minimum speeds for purposes of eligibility for stimulus grants or loans, it is a “static” and not particularly ambitious throughput minimum. Rather than being “forward looking,” it appears to have been set based on readily achievable speeds using previously installed technology. Applicants under the Broadband Technologies Opportunity Program (“BTOP”) and the Broadband Initiatives Program (“BIP”) need not deploy “cutting edge” technology to meet these thresholds. Moreover, given the limited timing for when these definitions will be relevant (the broadband funding under the ARRA is supposed to be distributed by September 30, 2010), there is little likelihood that the definition will be revisited to take into account developments in technology or applications.

A second significant problem with the Joint NTIA/RUS NOFA definition is that it relies on “advertised speeds,” which is itself a term that is undefined in the NOFA, and as far as we can tell, subject to no real limits under current FCC or Federal Trade Commission (“FTC”) regulations. The Commission’s Rules contain no specific references to “advertised speeds,” and the Commission provides little indirect guidance to Internet access providers as to what speeds they can advertise.

One potential Commission source for measuring speed, at least by analogy, is the

broadband reporting obligations. The instructions for the Form 477, which requires broadband service providers to report broadband connections under different speed tiers, direct filers to base the “speed” on the end user’s authorized maximum information transfer rate.⁶ That is, the reporting for the FCC Form 477 speed tiers is based on contract provisions, not on the actual throughput capability. When the Commission adopted the requirement to report broadband connections under different speed tiers in 2004, it declined to require filers to categorize connections by the speed that is actually observed by the end users.⁷ However, the Commission went on to state that broadband service providers need to be mindful of “general consumer protection laws” with regard to their advertising of broadband speeds.⁸

The FTC is charged with establishing and enforcing advertising claims such as broadband speeds. The FTC does not have any explicit rules concerning advertising of broadband speeds, although it does generally require that advertising must be truthful and non-deceptive, and that advertisers must be able to substantiate their claims. The FTC general policy on false or deceptive advertising states:

⁶ Form 477 Instructions at p. 6 (“In categorizing connections as “broadband,” filers should consider the end user’s authorized maximum information transfer rate (“speed”) on that connection.”). On the other hand, the Form 477 Instructions when addressing whether broadband service is “available” for reporting purposes, indicates that ILECs and cable systems “should take into account rule-of-thumb lessons from the experience of deploying particular broadband services in similar areas (*e.g.*, differences between actual and theoretical availability of xDSL service to end user premises in areas in which the service has already been deployed, such as may arise due to loop conditioning factors and loop length.)”. *Id.* at pp. 9-10.

⁷ *Local Telephone Competition and Broadband Reporting*, 19 FCC Rcd 22340 (2004) at ¶ 27.

⁸ *See also, Joint FCC/FTC Policy Statement For the Advertising of Dial-Around And Other Long-Distance Services To Consumers*, 15 FCC Rcd 8654 (2000) at ¶¶ 4-5.

The Commission intends to continue vigorous enforcement of this existing legal requirement that advertisers substantiate express and implied claims, however conveyed, that make objective assertions about the item or service advertised. Objective claims for products or services represent explicitly or by implication that the advertiser has a reasonable basis supporting these claims. These representations of substantiation are material to consumers. That is, consumers would be less likely to rely on claims for products and services if they knew the advertiser did not have a reasonable basis for believing them to be true. Therefore, a firm's failure to possess and rely upon a reasonable basis for objective claims constitutes an unfair and deceptive act or practice in violation of Section 5 of the Federal Trade Commission Act.⁹

Presumably a broadband service provider under these somewhat vague standards could rely upon laboratory tests to substantiate advertised “up to” speeds, even though the actual throughput that will be experienced by end users will rarely, if ever, match the results that can be achieved in the laboratory.

For wireless services, the actual throughput a subscriber will experience will depend on a number of factors, including distance from the base station, terrain and the number of subscribers using the service within range of the base station/tower (since the “last mile” capacity is shared). For cable broadband services, which also share capacity in the “last mile,” the speed the subscriber can achieve at any time will depend on the concurrent usage by his or her neighbors. For DSL services, the speeds experienced by any particular user can vary based on distance from the central office/remote terminal and the quality of the copper loop.

The FTC has not directly addressed the issue of advertising broadband speeds. The FTC recently conducted an examination of broadband in order to determine whether any new regulations were necessary, concluding that no new regulation was called for at

⁹ *FTC Policy Statement Regarding Advertising Substantiation*, available at <http://www.ftc.gov/bcp/guides/ad3subst.htm>.

this time. With regard to the issue of broadband speeds, the FTC acknowledged the divergence between “potential” and “actual” speeds, which will vary depending on architecture, number of users and other factors.¹⁰ The FTC Staff Report also specifically mentions workshop discussions of advertising “up to” versus “average” speeds, but does not resolve or provide guidance on such advertising.¹¹ Thus, advertising of broadband speeds is constrained only by the general prohibitions on deceptive advertising, which does not prevent a service provider from claiming theoretical/laboratory throughput as “advertised speeds.” As explained below, the Commission should define “broadband” in a manner that accounts for the subscriber’s experience, as opposed to the definition incorporated in the NOFA.

B. Experiential Definition of Broadband

ADTRAN encourages the Commission to define “broadband” from the perspective of the subscribers’ experience. ADTRAN also believes that the definition should be multidimensional and evolutionary (rather than static). As such, ADTRAN believes that “broadband” should incorporate speed (or throughput) as reflected in the rate that subscribers actually experience or are likely to experience with high probability (“sustainable” speed), as opposed to some theoretical maximum or peak rate. In looking at what speed (or speeds) qualify as broadband, ADTRAN believes that the Commission should base this value on a throughput level that will allow subscribers to use most common classes of applications with an acceptable quality of experience. As such, the

¹⁰ *FTC Staff Report*, “Broadband Connectivity Competition Policy (June 2007) at pp. 107-08.

¹¹ *Id.* at 131-32.

“minimum speed” could vary over time as the types and mix of Internet applications change. In addition to speed, “broadband” should incorporate a latency component, because latency greatly affects the subscriber’s quality of experience for most classes of applications.

While the user’s sustainable speed can be measured in a deployed network, it can be notoriously difficult to predict for network architectures in which there is a complex relationship between shared resources, the pool of subscribers sharing those resources, and the traffic demand placed on the network by the subscribers. Because of this, the primary metric used to define broadband prior to physical deployment (for instance, during a proposal or funding phase of a deployment) should be the rate capacity per subscriber. The access network must provide enough capacity, in both the upstream and downstream directions, to meet the traffic demands placed on it by the pool of subscribers it serves. The capacity should be sufficient to handle both diurnal variation in demand and the “burstiness” inherent in user traffic.¹² If an access network provides sufficient capacity per subscriber, then the desired sustainable speed can be met with a wide range of “peak” rates (so long as the peak meets or exceeds the sustainable value).

Another important characteristic for broadband is latency, which should be defined as the minimum delay across the access network in the absence of congestion. A number of important broadband applications, including interactive voice and video and

¹² ADTRAN, *Defining Broadband Speeds: An Analysis of Required Capacity in Network Access Architectures*, White Paper, attached to Letter from Stephen L. Goodman, Counsel for ADTRAN, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 09-51 (filed June 23, 2009).

online gaming, require a low latency connection for acceptable performance. Even web browsing is more dependent on latency than on rate for performance in most cases.¹³

The definition of broadband should avoid references to “peak rate.” This metric has relatively little value because its relationship to the rate actually observed by the subscriber varies significantly depending on the access network architecture. If the peak rate is limited by a resource dedicated to a single subscriber (such as a digital subscriber line) or by an artificial rate cap that limits the subscriber rate to significantly less than the bandwidth available in any shared resource, then subscribers may frequently experience throughput close to the peak value. In contrast, if it is limited by a resource which is shared by many other subscribers, then throughput close to the peak rate may be a rare occurrence.

The scope of each of the metrics listed above should be the access network, defined from the point of demarcation where the access provider’s network interfaces with the Internet, to the point of demarcation where the access network interfaces with the customer’s network (or computer). This scope encompasses the domain over which the access provider has control over the relevant parameters.

The *Section 706 NOI* raised questions whether the definition should reflect different tiers or otherwise vary by technology.¹⁴ ADTRAN believes that the

¹³ ADTRAN, *Defining Broadband: An Analysis of Latency in Network Access Architectures*, White Paper, attached to Letter from Stephen L. Goodman, Counsel for ADTRAN, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 09-51 (filed June 23, 2009).

¹⁴ *Section 706 NOI* at ¶ 38.

Commission should develop a single definition for broadband that applies evenly across all types of broadband access. The definition of broadband should be focused on a user's online experience, rather than the underlying technology. In particular, defining broadband based on technology (such as wired vs. wireless) when establishing requirements for publicly funded deployment projects can skew investment away from the solutions that best serve subscribers' needs.

With respect to tiers, ADTRAN observes that the Commission already collects data on broadband deployment for various speed tiers. Such information is helpful in knowing the robustness of the broadband capabilities subscribers have access to in various parts of the country, assuming that the speed or throughput is measured in a meaningful manner as discussed above. ADTRAN does not believe that separate sets of tiers are appropriate depending on the technology, but rather that speed tiers should apply regardless of the technology used to provide service. ADTRAN would encourage the Commission to continue to collect such information for comparison and trend analysis purposes, as well as potentially for allowing "apples-to-apples" comparisons for funding or grant decisions. In setting the differing tiers, ADTRAN believes the Commission should periodically revisit where the lines are drawn based on the applications that subscribers are using (*e.g.*, streaming video, IPTV, telepresence).

The *Section 706 NOI* also raised the question of whether symmetric speeds should be reflected in the definition of "broadband."¹⁵ As noted above, ADTRAN believes that the definition should be driven by the common classes of applications presently used by subscribers. ADTRAN does not believe that the vast majority of current applications

¹⁵ *Section 706 NOI* at ¶ 37.

require symmetric speeds. Thus, ADTRAN would not incorporate symmetric speed requirements initially, but that could change if subscribers more widely utilize applications that require symmetric speeds.

Indeed, ADTRAN believes that the Commission should reexamine the various components of a “broadband” definition on a regular basis – every three years – to determine whether any changes are necessary.¹⁶ In setting the values initially, and conducting the triennial reviews, the Commission should rely on the industry in the first instance to develop the parameters. The procedures for a “negotiated rulemaking” could form the basis for an industry-led process to develop proposed components for the “broadband” definition.

II. *Developments in Last Mile Technologies*

The *Section 706 NOI* seeks comment on technology trends since the last Section 706 Report in 2008.¹⁷ In discussing developments in last mile technologies since the *Section 706 Fourth Report*, the *Section 706 Fifth Report* mentioned very high-speed asymmetrical DSL (VDSL2) as being able to achieve speeds of 100 mbps at distances of a few hundred feet and 25 mbps at around 2,500 feet.¹⁸ Presently, maximum DSL throughput is reduced as the length of the copper loop increases, largely due to problems with cross-talk. Active spectrum management is being applied to DSL services as a

¹⁶ *Section 706 NOI* at ¶ 41.

¹⁷ *Section 706 NOI* at ¶ 50.

¹⁸ *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, 23 FCC Rcd 9615 (2008) at ¶ 12.

means of eliminating the cross-talk, and thus increasing the speeds available to subscribers to DSL services. Refinements in these techniques have continued to evolve since the Commission's *Section 706 Fifth Report*.¹⁹

Multiple input, multiple output (MIMO) signal processing techniques can mitigate both self and alien near-end and far-end crosstalk. One advanced spectrum management technique now in use is vectored DSL, which cancels the upstream or downstream crosstalk by coordinating signals at the central-office or line-terminal, thus increasing the data rates substantially over previous digital signal management methods. The term "vector" has been used to describe this technique because the DSL's individual physical layer voltages can be viewed as a coordinated set or "vector" of voltages.

The group or vector is processed by a common signal processing device for downstream transmission as well as for upstream reception. Essentially, the vector/MIMO processor performs pre-processing of the transmitted signal in downstream transmission via pre-coding or linear pre-filtering. The processor performs joint processing of the received signals in the upstream direction via receive filtering and successive cancellation. This vector or group processing allows cancellation or removal of crosstalk. The gain from the vectoring is largest when all the lines in the binder are processed simultaneously, but even partial vectoring or independent cancellation by different operators provide significant improvement over non-vectored systems.

Advanced spectrum management techniques are continuing to improve, which should further increase throughput capacity of the embedded copper loops. Even better

¹⁹ See, Presentation of Kevin W. Schneider, CTO ADTRAN, "Wireline Broadband Access," attached to Letter from Stephen L. Goodman, Counsel for ADTRAN, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 09-51 (filed June 23, 2009).

DSL performance can be achieved by using the hidden degrees of freedom in transmission compared to current differential-mode-based vectoring systems. In differential-mode vectoring, the signal is transmitted in the form of the difference between the signals of two lines in a twisted-pair (or two wires of a quad cable), and the number of degrees of freedom in a binder is equal to the number of pairs. In contrast, in full vectoring, the signal is transmitted through each line with respect to a single ground, which can be one of lines or a binder sheath. The signals on all wires can also be sensed (even when all modes are not excited), which is sometimes called "split-pair" sensing. These additional sensed signals can be very useful in the removal of crosstalk. Then, the number of degree of freedom is doubled compared to the differential vectoring. The increased number of transmit dimensions along with a possible multi-pair drop to each customer allows gigabit DSL service (0.5–1 Gb/s data rate per customer) using what is referred to as CuPON architecture.

These enhancements in DSL technologies have greatly improved the data rates that the loops are capable of supporting, roughly doubling the speeds since the Commission's last Section 706 report. VDSL2 can now support data rates of approximately 200 mbps at short distances, and up to 60 mbps at loop distances of one mile. Use of pair bonding and vectoring increases these capabilities even more. By combining vectoring and pair bonding, it should be possible for subscribers to experience speeds of just under 300 mbps at loop distances of 2,000 feet. At loop lengths of one mile, speeds of just under 100 mbps are possible, and loops of one-and-one-half mile are capable of speeds of 50 mbps. Thus, particularly when combined with extending fiber to remote terminals, even customers in somewhat remote areas can experience cutting-edge


data rates without the significant cost of replacing all of the embedded copper loops with fiber optic cable. And even greater enhancements will be made possible with CuPON architecture.

III. *Conclusion*

ADTRAN applauds the Commission's attempt in this proceeding to determine whether Americans continue to have access to advanced telecommunications capability in a reasonable and timely fashion. In conducting that analysis, as well as developing the National Broadband Plan, ADTRAN urges the Commission to define "advanced telecommunications capability" and "broadband" in a meaningful and consistent manner as discussed herein. ADTRAN believes the Commission will ultimately answer the question in the affirmative, particularly in light of continuing advances in broadband technologies.

Respectfully submitted,

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